

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Method of and Apparatus for the Connecting of Workpieces, more particularly Wooden Workpieces, by means of an Adhesive Substance

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and of German nationality, all trading as
HUBEL & PLATZER of Tirschenreuth/
Oberpfalz, Germany, do hereby declare the
invention, for which we pray that a patent
may be granted to us, and the method by
which it is to be performed, to be particu-
larly described in and by the following state-
ment:—

15 The invention relates to a method of and
an apparatus for the end-to-end connection of
workpieces, more particularly wooden work-
pieces, by means of an adhesive substance, the
said workpieces being provided at their end
20 faces with dove-tailing or a similar configura-
tion, and wherein the workpieces are tempor-
arily pressed against one another for the
purpose of connecting them together at their
processed end faces which have been pro-
25 vided with adhesive substance.

Apparatus of this kind are known which
operate in a timed manner in such a way
that the workpieces which are laid on sup-
porting tables and arranged separately from
30 one another for connection e.g. gluing to-
gether, are moved towards one another by
movement of the supporting tables relatively
to one another, and in this operation are
pressed against one another in order to pro-
35 duce the gluing pressure. Whilst the applica-
tion pressure is exerted, and also during the
setting of the adhesive substance, the work-
pieces are in a condition of rest, so that no
continuous feeding movement can take place.

A machine for the production of parts of
cabinetwork panels from strips is also known
wherein a supporting table tapering in the
direction of feed of the strip is provided with
a glue application device for the longitudinal
45 sides and a glue application device for the
end faces of the strips, and feeding and press-
ing devices are arranged which connect the
strips to one another continuously at their
end faces. But in this case the essential feature
is the lateral gluing i.e. the gluing which is
50 effected at the longitudinal sides of the strips,
whilst the strips at their end faces only abut
flush on one another and are substantially
only provided with glue at these end
55 faces in order to avoid having marked
joint gaps between the end faces of the strips
which would later make their presence
apparent after the middle layer is veneered.
Since cross-grain wood does not allow a load-
bearing glued connection, a true connection of
60 the strips at their end faces is not possible.

Furthermore, in that known machine a
continuously effective but only slight longi-
tudinal application pressure is produced in
that the feed rollers are given a slower rota-
65 tional speed than the drawing-in rollers so that
a slight detaining effect is constantly produced
as the workpieces are advanced. This method
permits of applying only a very slight and
non-regulatable application pressure in the
70 longitudinal sense over the entire length of
the strip, a pressure which is not capable of
producing a load-bearing connection of the
workpieces to one another at their end faces.

In contrast, the invention aims at providing
75 a method and an apparatus which are in-
tended exclusively for the longitudinal con-
nection of workpieces which are only arranged

[Price 4s. 6d.]

in a row one behind the other and which are provided at their end faces with dovetailing or a similar configuration guaranteeing a large surface for taking the adhesive substance. The adhesive substance, which is applied to the surfaces which extend approximately parallel to the longitudinal axis of the workpieces, i.e. in the case of wood approximately parallel to the longitudinal direction of the fibres, is to produce load-bearing connections of high strength values which require that the wood pieces are pressed into one another with high pressure, overcoming the preload resulting e.g. from the dovetailing.

Accordingly, in a method for the longitaining connection of workpieces provided at their end faces dovetailing or a similar configuration, by means of an adhesive substance, and more particularly workpieces consisting of wood, wherein the workpieces are temporarily pressed against one another at their processed ends which are provided with adhesive substance, the invention provides that the workpieces are given a continuous feeding movement and, in order to produce the connection or several simultaneous connections, the feeding movement of the forward workpiece in each case, considered in the direction of feed, is delayed relatively to the feeding movement of the following workpiece or workpieces temporarily to effect the pressing of the workpieces together by a braking means which participates in the delayed feed movement and is automatically brought into operating, at a specific position of the connection region or regions.

A particularly convenient form is obtained if the control is electrical and is effected on the basis of capacity measurement at a glued connection region. A connection region in each case can, in a manner known *per se*, be made to pass through a heating zone and then possibly through a cooling zone before the connected workpieces are further processed, in order to shorten the setting time for the adhesive substance as the workpieces are fed through the apparatus.

A preferred form of the apparatus for carrying the method into effect uses a compression element which is a pressure cylinder or a pressure cushion filled with pressure medium, the magnitude of the counter-pressure occurring at the said compression element as the workpieces are fed along being adjustable.

With the method and apparatus according to the present invention, on the one hand no interruptions in the feeding movement of the workpieces are produced and on the other hand no continual slight detaining effect is produced during the feeding of the workpieces, but instead longitudinal application pressures are provided which are always applied to the workpieces intermittently during the feeding only when the workpieces are

to be pressed together at a joint face or simultaneously at several joint faces. For this purpose it is true that whilst using a continuous feeding movement for the workpieces use is also made of an arrangement whereby movement is delayed, but in contrast to the known machine this is achieved by delaying the particular forward workpiece relatively to the feeding movement of the following workpiece or workpieces temporarily i.e. only during the time taken to execute the pressing together. In this way, the method according to the present invention makes it possible to apply to every connection region or possibly simultaneously to several successive connection regions if appropriate, considerable longitudinal application pressures the intensity of which can be adapted to the particular dimensions of the workpieces.

Further features of the invention will become apparent from the following description of the preferred form of embodiment of the apparatus for carrying the method into effect which is shown in the accompanying drawing.

According to the drawing, there is arranged on the fixed load-bearing stand 1 a feed system 2 comprising rollers and adapted to introduce the workpieces 3 which are to be glued together e.g. wooden workpieces, into the apparatus or machine and at the same time to provide them with a pressure in the direction of feed which is adequate for pressing the joints e.g. dovetail joints, together. Downstream of the feeding device there is arranged, with some spacing therefrom, a counter-pressure slide 4. This is provided, for connection with each workpiece 3, with a pneumatic or hydraulic pressure cushion 9 with which a counter-plate 20 loaded by a spring element 21 is associated.

A control valve 8 which is constructed e.g. as an electromagnetic valve is arranged in the pressure medium conduit leading to the pressure cushion 9. A switch 7 with circuit breaker is arranged in the circuit containing the electromagnetic valve.

Arranged in the zone of maximum pressure between the feeding system 2 and the counter-pressure slide 4 are two condenser plates 5 which are situated in a high-frequency control circuit *a, b*. A current relay 6 is arranged in this circuit. Arranged after the switch 7 is a break switch 11 which is operated by the pressure of a pressure medium contained in a pressure cushion 10 associated with the counter-pressure slide 4. Also arranged in the high-frequency control circuit is a rotary condenser 12 which is used for regulating the capacitive current for various workpieces, more particularly for wood of varying moisture content.

Finally, there is arranged downstream of the counter-pressure slide 4, as viewed in the direction of feed, in a manner known *per se* a heating zone 13 by means of which the setting

time for the adhesive substance at the particular connection region passing through can be shortened.

5 The apparatus which has been described hereinbefore operates in the following manner. When, in the continuous advance of the work-
 10 pieces 3, a connecting region provided with an adhesive substance e.g. glue whose dielectric constant is greater than that of the work-
 15 piece, arrives between the condenser plates 5, the amplifier system with the current relay 6 which is provided in the high-frequency
 20 control circuit *a*, *b* responds and closes the switch 7 which is provided with circuit-breaker means. As a result, the electromagnetic valve
 25 8 allows the liquid or gaseous pressure medium to flow into the pressure cushion 9 of the counter-pressure slide 4. This *per se* known
 30 pressure cushion presses the workpiece traveling in the direction of feed fast against the counter-pressure slide 4. The latter also moves
 35 in the direction of feed, whereby pressure is produced in the pressure element 10 which acts in a direction opposite to the direction
 40 of feed, and which may be constructed as a pressure cushion of elastic material e.g. solid rubber or as a mechanical compression or
 45 tension spring, but may also be constructed as a pneumatically or hydraulically operating pressure cylinder or hose, a pressure which is
 50 directed oppositely to the direction of feed and is regulatable by means of the break switch 11, and as a result the workpieces 3
 55 are pressed against one another at their end faces. When the pressure set at the break switch 11 is reached, this switch interrupts
 60 the current-conducting line to the electromagnetic valve 8 so that the pressure medium in the pressure cushion 9 of the counter-
 65 pressure slide 4 escapes and the pressure stored up in the pressure cushion 10 pushes the counter-pressure slide back into its initial
 position. The break switch 11, which can be constructed as an electro-hydraulic switch, an electro-pneumatic switch or as a mechanical
 pull switch, is connected to the current relay 6 and switches on again after the discontinuance of the load current and the reduction of
 the counter-pressure.

50 The operations which have been described are repeated when the next connection region of the workpieces arrives between the condenser plates 5.

55 As already mentioned, in order to shorten the setting distance required by the adhesive substance, the workpieces can, after the pressing operation, travel through a heating zone 13 which can be provided with contact
 60 heating means, infra-red heating means or combinations of these means. The drawing shows diagrammatically the possibility of using a high-frequency heating means. In this case
 65 the electrodes 14 are connected at the terminals *c* and *d* to the high-frequency generator. The heating action is continuous during

operation of the apparatus. With high-frequency heating, the glue joint is preferred owing to the higher dielectric constant of the adhesive substance.

It is possible to follow the heating zone 13 70 by a cooling zone 15 in which the workpiece 3 is cooled before further processing by contact with the machine stand 1 and by convection.

At the rear end of the machine, finally, 75 there can be arranged a clamping device 16 which is used when connecting together workpieces which do not require high pressing-together pressures such as e.g. strips of wood having a small cross-section. With this kind 80 of pressing, the pressure zone is situated between the clamping device 16 and the feeding system 2. The counter-pressure slide 4 with the condenser plates 5, the amplifier and current relay 6, the switch 7 with circuit 85 breaker means, the electromagnetic valve 8, the pressure cushions 9 and 10, the break switch 11 and the rotary condenser 12 can in this case be left inoperative.

The clamping device 16 consists of a stirrup 90 member 17 which is connected fast to the stand 1, a screwthreaded spindle with handwheel 18 and a clamping shoe with two rollers 19. The counter-pressure in the longitudinal direc- 95 tion is brought about by the fact that the clamping shoe 19 with the screwthreaded spindle 18 by means of the stirrup 17 presses the workpiece 3 firmly against the stand 1 and produces friction.

100 Instead of a screwthreaded spindle 18, it would also be possible to use in the clamping device 16 pressure cylinders and pressure hoses with hydraulic or pneumatic pressure media, and also clamping shoes without rollers.

WHAT WE CLAIM IS:—

105 1. Method of connecting end-to-end, by means of an adhesive substance, workpieces provided at their end faces with dovetailing or a similar configuration, more particularly 110 wooden workpieces, wherein the workpieces are pressed temporarily against one another for connecting purposes with their end faces which have been provided with adhesive substance, wherein the workpieces are given a continuous 115 feeding movement and, in order to effect the connection or several simultaneous connections, the feeding movement of a forward workpiece in each case, as viewed in the direction of feed, is delayed relatively to the feeding move- 120 ment of the following workpiece or workpieces temporarily to effect the pressing of the workpieces together by a braking means which participates in the delayed feed movement and is automatically brought into operation at a specific feed position of the connection region. 125

2. Method according to claim 1, wherein the braking means is an elastic means and is brought into operation electrically on the basis

of capacity measurement at the glued connection region.

3. Method according to claim 1 or 2, wherein the connection regions of the workpieces pass through a heating region to shorten the time required for the adhesive substance to set, and then, before further processing of the connected workpieces, through a cooling zone if necessary, as the workpieces are advanced.

4. Apparatus for carrying out the method according to any one of claims 1 to 3, wherein a counter-pressure slide is arranged upstream, of the feed direction, of a feeding system for the workpieces, the said slide being adapted to be pressed against a forward workpiece and, during the feeding of the workpieces, is adapted to be displaced with a delaying action along with the said workpiece in opposition to the action of an elastically yieldable tension or compression element.

5. Apparatus according to claim 4, wherein the compression element is in the form of a pressure cushion of elastic material which is arranged upstream of the counter-pressure slide and which acts in opposition to the direction of feed.

6. Apparatus according to claim 4, wherein the compression element is a pressure cylinder filled with pressure medium or a pressure cushion, it being possible to adjust the maximum value of the counter-pressure of the said pressure element produced when the workpieces are fed along.

7. Apparatus according to any one of claims 4 to 6, wherein the counter-pressure slide is provided, for temporary pressing against a workpiece, with a pneumatic or hydraulic pressure cushion whose counter-plate is loaded by a spring element.

8. Apparatus according to claim 7, wherein in the pressure medium conduit of the pressure cushion of the counter-pressure slide there is arranged a control valve which is constructed in a manner known *per se* as an electromagnetic valve.

9. Apparatus according to claim 8, wherein in the circuit extending through the electromagnetic valve there is arranged a switch with circuit breaker which can be operated through the agency of a current relay in dependence on the capacity at the connection region of the workpiece arriving between two condenser plates of a high-frequency control circuit.

10. Apparatus according to claim 9, wherein in the high-frequency control circuit there is arranged in a manner known *per se* a rotary condenser for regulating the capacitive current for various workpieces, more particularly for wood having varying moisture contents.

11. Apparatus according to claims 9 or 10, wherein after the switch there is arranged a break switch which, operated by the pressure of pressure medium contained in the pressure cushion arranged upstream of the counter-pressure slide, at the maximum value thereof, is adapted to interrupt the circuit through the electromagnetic valve in order to discontinue the pressing of the counter-pressure slide against the workpiece.

12. Apparatus according to any one of claims 4 to 11, wherein there is arranged after the counter-pressure slide, considered in the direction of feed, a heating zone for shortening the setting time of the adhesive substance at a particular connection region.

13. Method of connecting workpieces end-to-end according to claim 1 substantially as hereinbefore described.

14. Apparatus for connecting workpieces end-to-end according to claim 4 substantially as hereinbefore described with reference to the accompanying drawing.

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1 SHEET

COMPLETE SPECIFICATION

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the Original on a reduced scale*

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